Specification
For a
Downsized Deployable Satellite Terminal System

1. INTRODUCTION

The downsized deployable satellite terminal (DDST) system will be used for high precision timing experiments on the C band, Ku band, and X band satellites. The DDST system will be used on DSCS satellites and Intelsat satellites. The DDST system will interface with NRL developed two-way satellite time transfer modems.

The DDST system must be portable. It must be able to be shipped in crates that require no more than two people to carry. NRL personnel must be able to assemble, operate, and disassemble the DDST system.

2. SCOPE

The contractor shall furnish a complete DDST system that is Intelsat certified and Defense Satellite Communications System (DSCS) certified for both transmission and reception of signals. The contractor shall furnish all packaging material that will allow for the storage and transportation of the DDST system and all of its components. The contractor shall furnish all components required to operate on the three satellite bands, X, C, and Ku.

3. TECHNICAL REQUIREMENTS

The contractor shall provide a total system in which the individual sections or components must meet or exceed the following specifications as described below:

3.1   Antenna Interface

The reflector size must be 2.4 meters in diameter. The polarization of the antenna feed must be circular and support right-hand and left-hand polarizations for the C-band and X-band. The antenna must support linear polarization for the Ku-band.

3.2   Operation Data Unit Interface

TX IF Input
Connector   Type "N" female
Impedance   50 Ohms nominal
VSWR   1.5:1 maximum

RX IF Output
Connector   Type "N" female
Impedance   50 Ohms nominal
VSWR   1.5:1 maximum

RX IF Monitor

Connector   Type "N" female
Impedance   50 Ohms nominal
VSWR   1-5:1 maximum

External 10 MHz Input
Connector   Type "N" female
Impedance   50 Ohms nominal
VSWR   2.0:1 maximum

Internal 10 MHz Output
Connector   Type "N" female
Impedance   50 Ohms nominal
VSWR   2.0:1 maximum

Serial Port/Alarm Connector
HPA Serial Port/Alarm Connector

TX RF Output
Connector   Type "N" female
Impedance   50 Ohms nominal
VSW.R   1.5:1 maximum

RX RF/IF
Connector   Type "N" female
Impedance   50 Ohms nominal
VSWR   1.5:1 maximum

AC Input
Connector   Amphenol T3110-003

3.3   Receive Section

Receive RF Input Frequency
C-Band   3.625 - 4.200 GHz
X-Band   7.250 - 7.750 GHz
Ku-Band (with 3LNB's)   10.950 - 12.750 GHz
Band 1   10.950 - 11.700 GHz
Band 2   11.700 - 12.200 GHz
Band 3   12.250 - 12.750 GHz

Receive IF Output Frequency
C-Band   950 - 1525 MHz
X-Band   950 - 1450 MHz
Ku-Band   950 - 1700 MHz

LNA/LNB Noise Temperature (K)
C-Band   45K maximum
X-Band   75K maximum
Ku-Band   75K maximum

LNA/LNB Gain
C-Band   59 to 66 dB
X-Band   50 dB minimum
Ku-Band   50.5 to 57 dB

Antenna Gain (@ center frequency)
C-Band   38.06 dB
X-Band   43.80 dB
Ku-Band   44.00 dB

Receive G/F @ center freq., 10 deg. Elevation, clear horizon
C-Band   18.1 dB/K
X-Band   23.4 dB/K
Ku-Band   25.4 dB/K

Receive IF Output Power @ PI dB +8 dBm minimum
Receive IF Gain Adjustment 30 dB in 1 dB steps
Receive Frequency Sense Positive (no spectrum Inversion)

Receive Phase Notice
C/Ku-Band
@ 10 Hz offset   -35 dBc/Hz maximum
@ 100 Hz offset   -60 dBc/Hz maximum
@ 1 KHz offset   -70 dBc/Hz maximum
@ 10 KHz offset   -80 dBc/Hz maximum
@ 100 KHz offset   -90 dBc/Hz maximum
@ 1 MHz offset   <=-90 dBc/Hz maximum

X-Band
@ 10 Hz offset   -35 dBc/Hz maximum
@ 100 Hz offset   -62 dBc/Hz maximum
@ 1 KHz offset   -72 dBc/Hz maximum
@ 10 KHz offset   -82 dBc/Hz maximum
@ 100 KHz offset   -92 dBc/ffz maximum
@ 1 MHz offset   <=-92 dBc/Hz maximum

3.4   Transmit Section

Transmit IF Input Frequency
C-Band   950 - 1525 MHz
X-Band   950 - 1450 MHz
Ku-Band   950 - 1700 MHz

Transmit RF Output Frequency
C-Band   5.850 - 6.475 GHz
X-Band   7.900 - 8.400 GHz
Ku-Band   13.750 - 14.500 GHz

Transmit EIRP (@ center frequency and rated power)
C-Band   65.5 dBw
X-Band   68.6 dBw
Ku-Band   72.3 dBw

Antenna Gain (@ center frequency)
C-Band   42.10 dB
X-Band   44.40 dB
Ku-Band   49.00 dB

TWTA Rated Power (@ TWTA flange)
C-Band   290W
X-Band   400W
Ku-Band   290W

Transmit Intermods (@ TWTA flange)

	C-band Linearized TWTA	X-band Linearized TWTA	Ku-band Linearized TWTA
C-band	-21dBc @251W	-18dBc @126W	-18dBc @126W
X-band	-25 dBc @100W	-25dBc @251W	-25 dBc @1—W
Ku-band	-18 dBc @100W	-18dBc @100W	-21dBc @200W

Spectral Regrowth

	C-band Linearized TWTA	X-band Linearized TWTA	Ku-band Linearized TWTA
C-band (QPSK,1/2FEC,6.3Mb/s)	-26dBc @251W	-26 dBc @126W	-26 dBc @126W
X-band (**OQPSK**,1/2FEC,6.3Mb/s)	-30 dBc @126W	-30 dBc @251W	-30 dBc @126W
Ku-band (QPSK,1/2FEC,6.3Mb/s)	-26dBc @100W	-26dBc @100W	-26 dBc @200W

Transmit Spurious
AC Line   -40 dBc maximum (<500 Hz)
All Others
C/Ku-Band   -55 dBc maximum (500 Hz - 1 GHz)
X-Band   -70 dBc maximum (>2 kHz - 1 GHz)
Transmit RF Gain Adjustment   25 dB minimum in 1 dB steps

Transmit Frequency Sense
Transmit Phase Noise
        C and Ku-Band   @   10 Hz offset   -35dBc/Hz maximum
                           @   100 Hz offset   -60dBc/Hz maximum
                           @   1 KHz offset   -70dBc/Hz maximum
                           @   10 KHz offset   -80dBc/Hz maximum
                           @   100 KHz offset   -90dBc/Hz maximum
                           @   1 MHz offset   <= -90dBc/Hz maximum

X-Band   @ 10 Hz offset   -35dBc/Hz maximum
                           @ 100 Hz offset   -62dBc/Hz maximum
                           @ 1 KHz offset   -72dBc/Hz maximum
                           @ 10 KHz offset   -82dBc/Hz maximum
                           @ 100 KHz offset   -92dBc/Hz maximum
                           @ 1 MHz offset   <= -92dBc/Hz maximum

Transmit Frequency Stability
Day 1×10^{-9} maximum
Year 1×10^{-7} maximum

Temperature (-30' to +50' C)
Pattern Beamwidth @ Center Frequency
-3dB Beamwidth

C-Band	1.35 degrees
X-Band	1.02 degrees
Ku-Band	0.60 degrees

-15 dB Beamwidth

C-Band	2.84 degrees
X-Band	2.14 degrees
Ku-Band	1.26 degrees

3.5 MONITOR AND CONTROL

The serial port interface must be compatible RS232 and RS485 interface standards. The DDST system must provide monitor and control functions listed below.

Transmit	Set RF attenuator
	Enable/Disable transmit
	Enable/Disable time delay
	Enable/Disable, TWT
	Reset latched alarms
	Monitor alarms
	Monitor TX frequency
	Monitor TX power
	Monitor TWT

Receive	Set IF attenuator
	Enable/Disable receive
	Reset latched alarms
	Monitor alarms
	Monitor RX attenuator setting

3.6 POWER REQUIREMENTS

The DDST system must operate on 115 +/= 10% volts AC, and 230 +/- 10% volts AC with a line frequency varying from 47 Hz to 60 Hz. The power consumption must not exceed 190 VA with the transmitter off. The transmitter must not exceed 2500 VA in power consumption.

3.7 MECHANICAL REQUIREMENTS

The contractor shall provide cases for storage and transportation of antenna components and systems. The DDST system should be assembled in less than an hour by two trained operators. No more than basic hand tools should be required for assembly or disassembly.

4. DOCUMENTATION

4.1 Technical and Operations Manual

The contractor shall provide a manual that describes the interfaces of the DDST system, assembly and disassembly procedures, operating procedures, and maintenance and troubleshooting procedures.

4.2   Test Data and Certification
The contractor shall provide certification of compliance and registration for use on Intelsat satellites and DSCS satellites. The DSCS certificate shall indicate that the DDST has been tested and approved for operations on DSCS satellites. The document shall include all required registration numbers. The Intelsat certificate shall indicate that the DDST system has been tested and approved to operate on Intelsat satellites. The document shall include all required registration numbers. The contractor shall provide test data indicating the performance levels of the receiver and transmitter sections. Delivery of test data shall take place with the delivery of the DDST system.

5.   TECHNICAL SUPPORT
The contractor shall provide telephone/fax/email technical support for a period starting with delivery of the complete DDST and extending 90 days after delivery.

6.   WARRANTY
The contractor shall provide a standard commercial warranty for the DDST.